a plinth welded to the diode casing, the plinth comprising (a) a plug portion adapted to be force-fitted into an aperture and defining an axis of the plinth, and (b) an abutment portion projecting with respect to the plug portion in a direction radial to said axis, wherein the plug portion has a smaller radius than the abutment portion,

and with the plug portion of the plinth force-fitted into said hole in the support.

9. (amended) The alternator according to claim 8, wherein the abutment portion of the plinth is disposed on an opposite side of the support from a stator.

REMARKS

A. Status of Pending Claims and Explanation of Amendments

Claims 1-19 are pending in this application. Claims 8-10 were rejected under 35 U.S.C. §112, ¶2, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Office Action alleges that claims 8 - 10 are vague because it is unclear whether Applicant is attempting to claim an assembly of parts or an alternator. Claim 8 has been re-written in independent format to further clarify the invention being claimed as an alternator. Claim 9 has been amended to correct a minor grammatical error. Entry of these amendments is requested under 37 C.F.R. §1.116 as complying with matters of form raised in the Office Action. These amendments were not made for issues related to patentability (§§102 and 103).

Claims 1-7 and 11-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,472,649 to Namba et al. ("Namba"), U.S. Patent No. 4,321,664 to Matthai

("Matthai"), and U.S. Patent No. 3,812,390 to Richards ("Richards"). Claims 8 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Namba, Matthai, and Richards, in further view of U.S. Patent No. (4,286,186) to Hagenlocker. Claim 10 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Namba, Matthai, Richards, and Hagenlocker, in further view of U.S. Patent No. 5,828,564 to Mori ("Mori").

B. Applicants' Claims are Patentably Distinct over the Cited References.

The July 8, 2002 Office Action attempts to combine Namba, Richards, and Matthai to arrive at Applicants' invention. However, this combination fails to provide all elements of the Applicants' invention, and in particular fails to provide a "diode having a casing that is welded on the plinth." Further, there is no proper motivation to combine the cited references, because the proposed modification would either not function in the manner suggested by the Office Action or would render the one of the references unsatisfactory for it is intended purpose. For these reasons, the §103(a) rejections are improper and should be withdrawn (MPEP §§ 2143.01 and 2143.03)

1. The Cited References Fail to Provide a "Diode Having a Casing that is Welded on the Plinth" As Recited in Applicants' Claims.

Applicants' claim 1 recites, *inter alia*

> A plinth for supporting a diode having a casing that is welded on the plinth, the plinth including a plug portion adapted to be force-fitted into an aperture and defining an axis of the plinth, an abutment portion disposed between the plug portion and the diode casing, ...

In the rejection of claims 1-7 and 11-19, the Office Action relies on Namba for a diode

fixed to a cylindrical plinth with a plug portion force fit into an aperture, but admits that Namba does not teach a diode having a housing welded to the plinth. (Office Action at page 3, lines 2-4).

For a diode with a housing, the Office Action relies on the diode CH of Matthai, which has a plastic housing K to protect the diode. (See Figure 3). However, Matthai does not teach a diode housing fixed by welding, (see Office Action at page 3, line 5), and thus does not teach, disclose, or suggest a "diode having a casing that is welded on the plinth".

Moreover, Richards does not teach, disclose or suggest "diode having a casing that is welded on the plinth". Instead, Richards merely suggests that diodes may be soft soldered or spotwelded to a metal plate. This metal plate is not a "casing" and the Office Action does not contend otherwise. Accordingly, Richards, like Namba and Matthai, do not teach a "diode having a casing that is welded on the plinth" as recited in claim 1. Because not all elements are shown, the rejection should be withdrawn. (MPEP §2143.03)

2. <u>There is No Motivation to Combine the References Cited in the Office Action</u>

Applicants respectfully further assert that the combination of Namba, Matthai, and Richards is incapable of producing Applicants' invention. In particular, the plastic housing of Matthai, which the Office Action relies on for a "casing", cannot be spotwelded or soft soldered in the manner taught by Richards to produce "a diode having a casing that is welded on the plinth" as recited in Applicants' claims.

As discussed in the <u>New Encyclopedia of Machine Shop Practice (p. 374 and p. 389)</u>, the principle behind the techniques of spotwelding and soft soldering is to apply heat locally at regions of the two materials to be joined. This heat melts the materials at the soldering or

spotwelding junction, causing the materials to fuse together locally. This joint holds the two materials together.

In the case of spotwelding, small abutting regions (i.e., the "spots") to be joined are heated by passing a large current through them. Because current must be able to flow through the materials to be spotwelded, electrically insulating objects (such as the plastic housing of Matthai) cannot be spotwelded. Thus, the spotwelding process of Richards cannot be applied to the plastic housing of Matthai.

In the case of soft soldering, a solder material, such as a lead-tin alloy, is melted at the abutting regions to be joined, typically by heating it with a soldering iron. The solder material must be capable of locally alloying with both materials to be joined in order for successful soft soldering. For this reason, soft soldering is commonly used to join two metals together. Because plastic will not alloy or fuse with the solder material, the plastic housing of Matthai cannot be soft soldered to a metal object, such as a plinth. Further, it is likely that any attempt to soft solder the plastic housing of Matthai would result in thermal damage to the housing, given the relatively high temperatures required for soft soldering (see New Encyclopedia of Machine Shop Practice Table I, p. 390). This damage very likely would render the plastic housing unsatisfactory for its intended purpose, namely as a shell to protect the diode. Consequently, the soft soldering process of Richards also cannot be applied to the plastic housing of Matthai.

In summary, there is no proper motivation to combine these references, because the combination of these references (1) would not function in the manner suggested by the Office Action and (2) would render the prior art (i.e., the plastic housing of Matthai) unsatisfactory for its intended purpose. For at least these reasons, the rejection of claims 1-7, and 11-19 under 35 U.S.C. §103(a) should be withdrawn.

3. Claims 8 – 10 are Patentably Distinct for Similar Reasons

Independent claim 8 recites, *inter alia*, "...a diode having a casing, and a plinth welded to the diode casing...." For reasons similar to those mentioned above, claim 8 and dependent claims 9-10 are patentably distinct over the combination of Namba, Richards, and Matthai. Further, the secondary Hagenlocker and Mori references are not alleged to alleviate the shortcomings of these references. Accordingly, claims 8 –10 are also in condition for allowance.

CONCLUSION

For the foregoing reasons, it is respectfully submitted that the pending claims are in condition for allowance. In the event that a telephone interview would facilitate examination of this application in any way, the Examiner is invited to contact the undersigned at the number provided.

Respectfully submitted,
MORGAN & FINNEGAN, L.L.P.

Dated: January 6, 2003

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APPENDIX

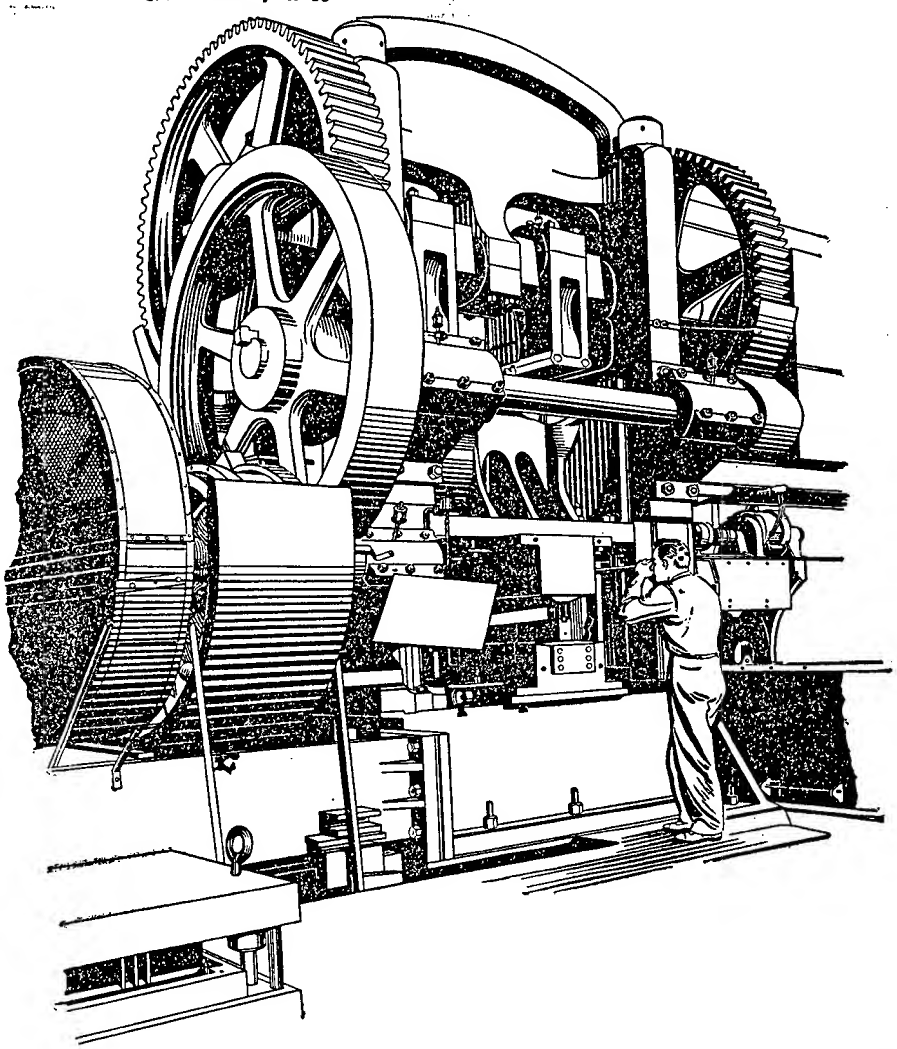
8. An alternator including a support having a hole, and an assembly [according to claim 5], said assembly comprising

a diode having a casing, and

a plinth welded to the diode casing, the plinth comprising (a) a plug portion adapted to be force-fitted into an aperture and defining an axis of the plinth, and (b) an abutment portion projecting with respect to the plug portion in a direction radial to said axis, wherein the plug portion has a smaller radius than the abutment portion,

and with the plug portion of the plinth force-fitted into said hole in the support.

9. The alternator according to claim 8, wherein the abutment portion of the plinth is [being] disposed on an opposite side of the support from a stator.

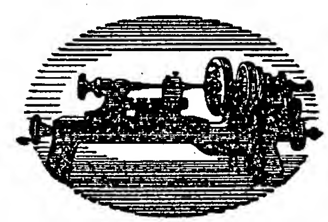


A punch press used in making electrical equipment in the Sharon, Pennsylvania, works of Westinghouse Electric and Manufacturing Company.

THE NEW ENCYCLOPEDIA OF MACHINE SHOP PRACTICE

A GUIDE TO
THE PRINCIPLES AND PRACTICE
OF MACHINE SHOP PROCEDURE

edited by
GEORGE W. BARNWELL
PROFESSOR OF PRODUCTION PRACTICE
STEVENS INSTITUTE OF TECHNOLOGY



New York
Wm. H. WISE & CO., Inc.
1941

PRINTED IN THE UNITED STATES OF AMERICA

CONTENTS

CHAPTER 12

WELDING, SOLDERING, AND BRAZING

USES OF WELDING. RESISTANCE WELDING. REPAIRING CASTINGS. TYPES OF JOINTS. ARC WELDING. GAS WELDING. COPPER AND BRONZE. USE OF THE BLOWPIPE. ALUMINUM. SOLDERING. TOOLS AND METHODS. BRAZING. PREPARATION OF WORK.

THE elemental principle of welding is seen in a common operation performed by the blacksmith over the anvil, where, by heating the ends of two pieces of wrought iron or steel to a white heat and hammering them together, they can be welded together. In good work of this kind it should not be possible to detect the joint. If this kind of joint is tested in a testing machine to pull it apart, it would most likely fail at the weld rather than in the actual metal, but a good hammer weld should have about 75 percent of the strength of the metal.

Chain is commonly made by hammer welding, and the familiar joints for work of this nature are shown in Fig. 1.

Operations of this kind are confined largely to odd-shaped pieces made for mill-wrights and the maintenance staff in connection with repair work, although a good deal of it is associated with the requirements of shipyard work.

Wrought iron is a better welding material than steel, because when steel is heated, the parts become coated with oxide of iron in the form of a black scale, and if this is not removed the weld will be defective. In the case of wrought iron, the metal may be safely heated to a temperature which will melt the oxide, which is then forced out during the hammering. But as this is too high a temperature at which to work steel, it is necessary to

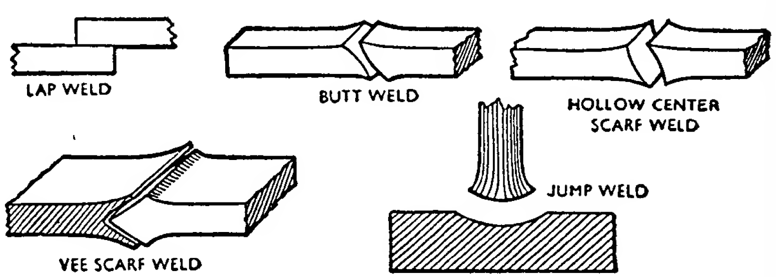


Fig. 1. Representative types of hand-made hammer welds as produced when using a blacksmith's forge. Good hammer welds should have about 75 percent of the strength of the metal. Chain is commonly made by hammer welding.

use a flux, usually borax. Borax powder and fine clean sand in equal parts makes a good flux, especially if mixed with 25 percent of iron (not steel) filings. In most cases, however, it is probably better to use one of the welding compounds which are sold specifically for different kinds of welding.

Welding of this kind can also be done in a forging press where pressure is applied in place of hammering. Extensive use is made of what is basically hammer welding in the fabrication of lap-welded pipe.

The pipe edges, suitably trimmed, are bent to the circle, the edges are heated by a gas flame and closed by hydraulic pressure in machines specially constructed for the purpose. The longitudinal seam of steel pipe is usually made in this way, although pipe is more often produced by a piercing and drawing operation from a piece of steel in present-day practice.

ELECTRIC WELDING

RESISTANCE welding is electrical welding done in machines, and is not usually to be regarded as a very skilled operation. Most of it is applicable to light work as a substitute for light riveting or soldering, and is classified as butt, flash, spot, and seam welding. The work is carried out by placing in contact the parts which require welding and passing a very heavy current at low voltage through them. The electrical resistance at the point of contact is high compared with the rest of the circuit, and the temperature at the joint rises rapidly. When welding temperature is reached, mechanical pressure is applied to join the metal into a sound weld.

Butt welding may be subdivided into slow butt welding and flash welding. In the slow weld the parts are brought into close contact and the current switched on. When welding temperature is reached, the parts are forced together, causing an upset at the weld. This method is used when welding solid uniform sections, and a typical machine is shown in Fig. 2.

For thin sections flash welding is used. In this process, the current is switched on and the parts brought together with only a slight pressure. Arcing takes place, and any unevenness at the ends burns away, while the whole area of the ends is rapidly raised to a high temperature. The application of a sudden heavy pressure forces out the burnt metal in the form of a thin fin, leaving only sound metal in the weld itself.

For light work, spot welding is now being used extensively as a substitute for riveting, to fasten two sheets of metal together by uniting them over an area equal to that of the rivet which would otherwise be used.

In this case, in a machine as shown in Fig. 3, the current is applied by means of two tips or electrodes between which two or more pieces are placed to be welded together. These electrodes are brought together by means of a hand-lever or pedal, or in certain types of machine by a power-driven mechanism.

Mechanical pressure is applied to them through a spring, and when the spring is compressed to a certain point, a switch is closed automatically. Current then flows until welding temperature is reached, then the spring is further compressed, completing the weld

it is not intended to form either a gas-tight or liquid-tight joint. For this purpose it is usual to make use of seam welding, which is done by passing the sheets between two copper disc electrodes which form part of the electrical circuit. The sheets become heated to welding temperature in the path of the electrodes, and the pressure between these completes the weld. This process is used in the manufacture of oil and paint drums, refrigerators, electric ovens, etc., and the materials for which it is best suited are mild steel and stainless steel. A maximum thickness of two $\frac{3}{16}$-in. steel sheets can be welded together.

In common with many other machines used in production work, it is essential, where a large number of parts must be produced, that the correct sequence of operations should be performed uniformly every time, and it is possible to do this by automatic and cutting off the current. In the majority of machines at present in use, the operator has to judge the correct temperature, though this can now be done automatically by automatic spot welders.

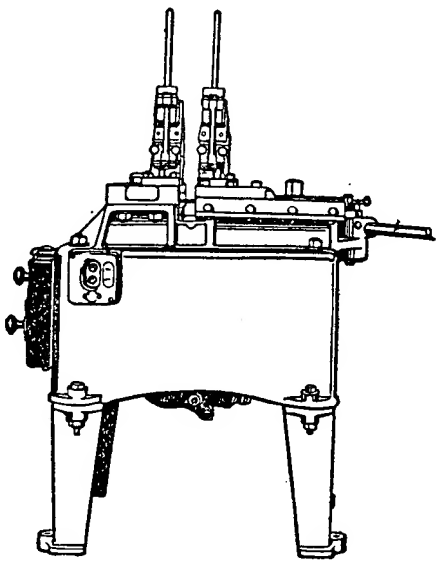


Fig. 2. Typical butt-welding machine used mainly for the welding of solid uniform sections.

Spot Welding

Spot welding is applied chiefly to the welding of steel from a few thousandths of an inch to half an inch thick, but brass, copper, and other non-ferrous metals of limited thickness may be welded safely. It can make as serviceable a joint as a riveted one, but

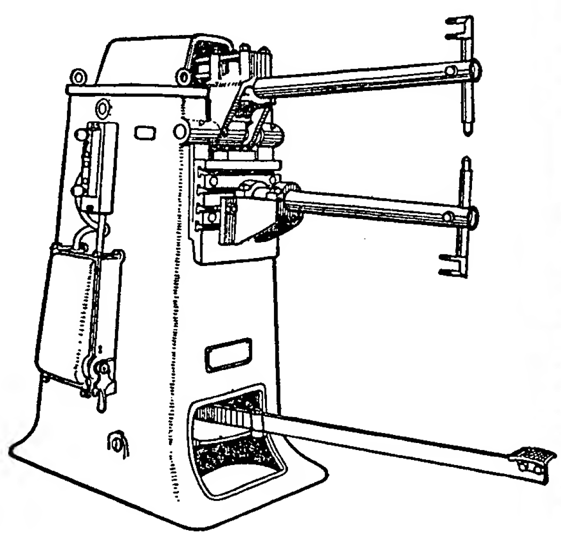


Fig. 3. Spot-welding machine. The electrodes are brought together by means of the pedal shown in the foreground.

means. A machine of this type, shown in Fig. 4, consists of a standard transformer and clamping gear, but with a special mechanism for welding. The parts to be welded are fixed in the machine with suitable clamps which may be either hand- or power-operated. The welding operation is then entirely automatic. There is a self-contained motor, driving the upset gear. This is set in motion, the slide is withdrawn slightly, the current switched on automatically, and then the slide moves slowly forward. When the parts to be welded make contact, flashing takes place, and this is continued for a certain time, allowing the two ends to become white hot in readiness for the final pressure. This is applied by means of a powerful spring, and the pressure is released after the welding has taken place.

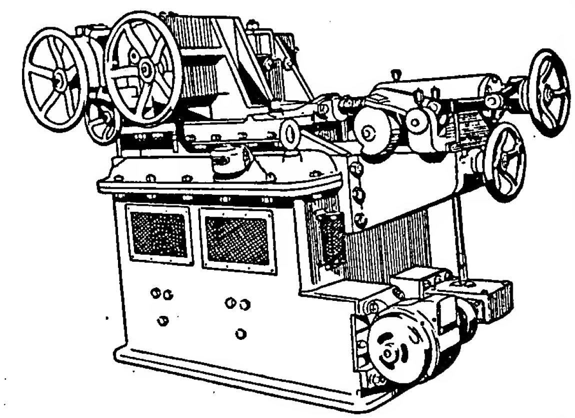


Fig. 4. For mass-production work an automatic welder of the type shown above is used.

Butt Welding

By means of machines like this thousands of welds can be made exactly alike, with the knowledge that the correct upsetting pressure has been applied to each one. The current is controlled by means of suitable cams on the driving shaft, and when the machine has once been set, no further adjustment is required when welding one kind of material.

Butt welding for comparatively heavy work is quite a recent development, sometimes referred to as flash-butt welding. The important thing is to have the faces of both parts being welded in contact over the whole section. Unless this condition is met, there is an uneven distribution of the current over the cross-section of the weld, and only some points of the cross-section are effectively welded. This is not so apparent in the welding of small parts, as the protruding points are generally very small, and shortly after the start of the weld, they are melted away, due to the higher pressure per unit of area. So that, the butt welding of objects with small cross-sections has always given good results. The abutting faces of large welds or those with complicated cross-sections must be carefully prepared and adjusted to each other before any actual welding is done.

The principal feature of the modern butt-welding machine for heavy parts, as shown on Fig. 5, is a means of applying considerable pressure, and in the particular one illustrated, in addition to the capstan wheel which operates the large screw through bevel gearing, there is a small motor driving the same gearing through a cone-clutch. The gearing is used when

Preparation of the work is the same as that for steel, and forward welding with special fluxes sold for the purpose is recommended.

Cast Iron Welding

The welding of cast iron is applied mainly to repair work as already indicated, and it is not to be undertaken by anyone who happens to be handy with a blowpipe. It very often happens that the part has to be machined to restore it to its working condition, but when cast iron is welded with a steel or iron electrode the fusion point is extremely hard and non-machinable, and the surface can be finished only by grinding. For this reason, Monel metal electrodes are now being used, as with proper welding apparatus they give a surface capable of being machined as readily as can the parent metal.

The Monel metal rods supplied for the metallic arc welding of cast iron are coated with a special flux, while bare Monel metal is supplied for oxy-acetylene welding and refined powdered borax used as a flux. With gas welding, it is necessary to preheat the casting. Where possible, electric welding is recommended.

Monel flows differently from any other welding metal, so that an operator must accustom himself to its use, and not expect to obtain the best possible results with the first attempt.

Monel metal should always be deposited on a cold section of the casting, and a bead not longer than 2 in. laid at one time. Immediately upon breaking the arc, this bead should be carefully peaned with a light ball pean hammer. This produces a forged effect in the welded metal and relieves it of the strains due to cooling.

Use of Blowpipe

Bronze welding by the blowpipe is a good method of doing some kinds of repair work to broken castings, and, being done at a lower temperature than fusion welding, the time and cost of preheating are reduced. It is possible to carry out many repairs without dismantling the machinery.

The technique requires manganese-bronze rod and a special flux. Welding proceeds by the forward method, as explained previously.

Heavy sections may be vertically bronze welded by metal deposited into a series of cups formed by steel cleats placed across the V. These control the metal so that a larger blowpipe can be used, increasing the speed of working on section of 1 in. and over, where otherwise it is hard to avoid spilling the molten bronze. They also add to the strength.

The cast iron is tinned with the blowpipe pointing upward at 70 deg. to the surface. Then a clean cleat is placed into position and tinned. Bronze from one or more filter rods is then rapidly deposited, with the blowpipe pointing down into the bath.

Aluminum

Provided suitable rod and flux are used, aluminum welding is not a difficult operation. The preparation of the plates is the same as that to be associated with other non-ferrous metals. The flux is of primary importance, however, as aluminum has an invisible film of oxide on the surface which it is the primary purpose of the flux to remove. Heavy-gage work should be preheated.

As a general rule, the diameter of the welding rod should be approximately equal to the thickness of the work. Butt joints should always be employed, since better results are obtainable and there is less danger of the incomplete removal of the flux after welding than there is in the case of lap joints. For sheets below 20 gage it is recommended that the edges should be bent up at right angles and the resulting flange simply melted down to form the joint without the use of a welding rod. Above 1/8 in., it is advisable to bevel the edges to insure the penetration of the weld metal.

On completion of the welding operation it is essential to remove all traces of flux. This can be done by brushing vigorously with hot water or by using a steam jet. Immersion in warm 5 percent nitric acid is recommended, to be followed by a thorough washing.

SOLDERING

Soldering comprises the uniting of two metals or alloys with the aid of a more soluble alloy or solder, or one with which they will more speedily join than with each other. It is customary to describe these more soluble alloys as soft solders, to distinguish them from the hard solders used for brazing (see Tables I, II and III). The types of metal that can be soldered include copper, nickel, tin, iron, lead, zinc, aluminum, and numerous of their alloys. It is also possible to solder nonmetallic substances together if they have first been provided with some form of metallic coating.

The first essential in good soldering is to insure that the metallic surfaces to be soldered are clean and completely free from dirt, grease, or adherent particles or films. Usually, the first operation is to clean the metals to be united, which is done either by hand with a file, a piece of sandpaper, or an emery cloth, or even a handful of sand, or, if available, by a pickling bath of acid or alkaline nature, which is especially suitable when dealing with large areas.

The next essential is correct heating of the soldering iron. This *iron* is not really of iron, but of copper (see Figs. 23–26). It must be *tinned,* or given a film of solder, before it can be used, and the commonest method of doing this, although not necessarily the most efficient, involves first a heating of the iron to a very dull red. Cleanliness of the tool is vital, so that it must next, while red hot, be swiftly filed on its faces to remove all dirt and oxide. It is then plunged into a flux, the purpose of which is to prevent the surfaces to be soldered from oxidizing, or to dissolve any oxides formed when the metal is heated. Zinc chloride is probably the commonest flux. Ammonium chloride is sometimes used with tin-lead solders applied at temperatures just above the melting point. Killed spirit is also used, while rosin and various preparatory fluxes are desirable for fine work on thin metal.

When fluxed, the soldering iron is brought into contact with a piece of solder, and the different faces are rapidly rubbed on a sheet of tin for the purpose of distributing the solder film evenly over the entire surfaces. If this work is correctly carried out, the point of the iron will be covered with an even film of solder. The evenness of this film must be maintained or the iron will not work properly. If the tinning

TABLE I
SOLDERING ALLOYS

TIN %	LEAD %	ANTI-MONY %	COPPER %	CADMIUM %	MELTING POINT DEG. F.	COMPLETE SOLIDIFICATION POINT DEG. F.
63	37				464	356
50	50	.12	.08		419	365
5	95				599	572
10–20	90–80				581–545	500–356
15–35	85–65				563–491	365
45	55				464–458.5	356
37.5	60	2.5			374	356
95	5				464	446
23	68			9	455	293
95		5			464	446
50	32			18	293	293
19	31	(50% bismuth)			203	203
13	27	(50% bismuth)		10	158	158
				95 (5% silver)	752	635
				50 (50% zinc)	617	509
				82.5 (17.5% zinc)	509	509

TABLE II
BRAZING ALLOYS

COPPER %	ZINC %	LEAD %	IRON %	TIN %	NICKEL %	MELTING POINT DEG. F.
50–53	Balance	.5	.1			1592.6–1616
52–53	"	.5	.1			1598–1616
Balance	45–50			3–5		1571
"	57–65		1.	5–9		1382–1400
"	55–59				7–9	1598
47	Balance				11	1697

TABLE III
SILVER SOLDERS

SILVER %	COPPER %	ZINC %	CADMIUM %	MELTING POINT DEG. F.	FLOW POINT DEG. F.
10	52	38		1508	1598
20	45	35		1427	1499
45	30	25		1247	1373
50	34	16		1283	1427
65	20	15		1283	1328
70	20	10		1337	1391
80	16	4		1364	1463
5			95	644	743
5		16.6	78.4	482	599
5.5			94.5 lead		
2.5	.25		97.5 "	563	671
50	15.5	16.5	18	1157	1157

is uneven, or even absent in places, the iron will have to be retinned.

The bit must never be heated to a temperature so great that the tinning is burnt off, since that will allow the iron to become oxidized and pitted. A simple test for correct temperature is to hold it about 6 in. from the cheek, when the heat from it should just be

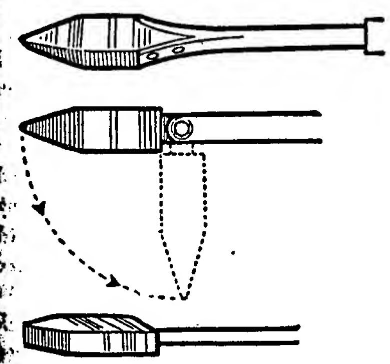


Fig. 23. *Top,* ordinary soldering iron; *center,* pivoted iron for awkward surfaces; *bottom,* internal iron for drums, churns, etc.

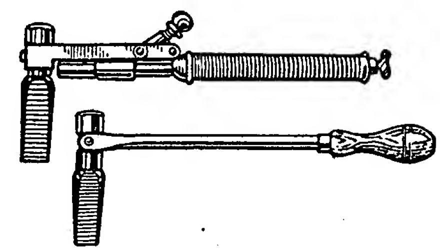


Fig. 24. Hatchet soldering irons. That above is a self-heating benzoline iron.

perceptible; some practice is necessary before this test can be applied with confidence. Another test is to touch the solder with the iron. Provided that both are clean, the solder should melt on contact.

The most effective tinning method is to employ a block of ammonium chloride or sal ammoniac, cut into oblong form, about 4 in. wide by 7 in. long by 1 in. thick, with a hollow gouged out of the upper flat surface (see Fig. 27). After cleaning and heating, the tool is inserted in this hollow and

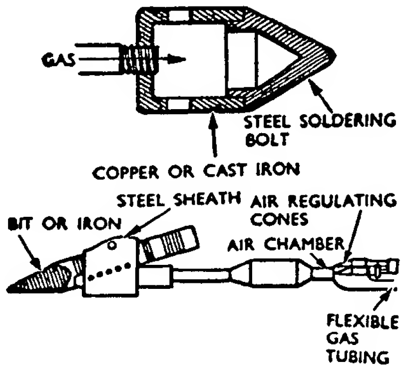


Fig. 25. *Top*, gas-heated soldering bit. *Bottom*, the complete assembly of above showing the various parts.

pressed down firmly. The result will be the giving off of considerable quantities of white smoke or fume, and the sal ammoniac will liquefy on the surface. Each face of the iron should be treated thus, and a few drops of solder should then be melted into the hollow while the bit is still there. This tins the iron quickly and evenly. The same process should be repeated whenever the tinning is destroyed. Since ammonium chloride attracts moisture, it should be kept well away from all steel tools, which it will otherwise attack and corrode.

The next stage to be dealt with here, though of course it will, in point of time, precede the preparation of the iron, is to prepare the joint to be soldered. Here again cleanliness is necessary and the surfaces of the joint must be cleaned as described earlier. The application of flux to these surfaces follows. A useful appliance for applying flux is shown in Fig. 28. The heated iron is then gripped in one hand and a piece of solder in the other. A small bead of solder is allowed to form on the joint, the iron is rested for a second on this to melt it, and is then passed over the edges quickly enough for these to acquire heat.

This, combined with the swift melting of the solder, creates a sound joint. Care is essential, because otherwise too much solder will make an ugly and bulky joint. The iron is moved lightly up and down the joint to spread the solder and cause the heat to soak thoroughly into the joint. If the iron is too cool the solder will be uneven, while if it is too hot the solder will not run smoothly.

The work must not be held in such a way that the flow of the solder is in the reverse direction to the inclination of the iron. In other words, the solder must flow downhill with the bit, not uphill against it (see Fig. 29).

The method of holding the iron is important. The elbow must be well away from the body, and the thumb right under the handle (see Fig. 29). The entire weight of the iron must be upheld and balanced on the thumb by the downward pressure of the lower portion of the hand.

Soldering irons are either plain—i.e., heated and applied by hand—electrically heated, gas-heated, alcohol-heated, or heated by means of a thermit block. Gas stoves capable of having their temperatures regulated accurately are the best for plain irons, but coke, oil, or charcoal are also used. Coal causes too much dirt on the bit. For making a uniformly smooth joint in a long job, the hatchet iron (see Fig. 24) is valuable. The copper bolt is riveted in the eye of the iron shank, the bit, however, being able to revolve if desired. With this type of bit there is a greater area of contact with the metal, and therefore the whole joint is heated more thoroughly.

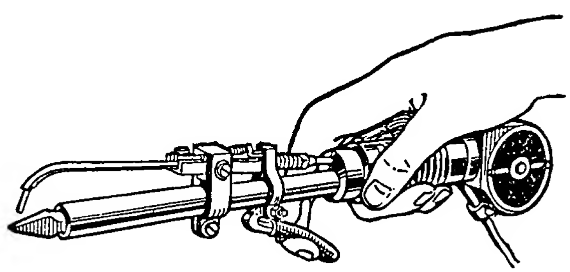


Fig. 26. Magazine electric soldering iron. Solder is fed to the bit by pulling the trigger.

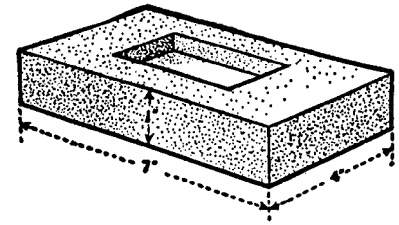


Fig. 27. Ammonium chloride block for tinning. It should be cut to the size given and a hollow gouged out of the upper surface as indicated

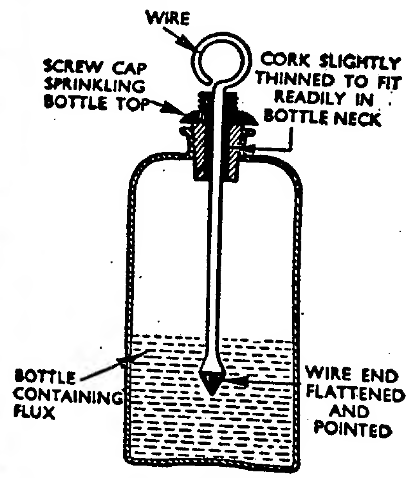


Fig. 28. Useful appliance for applying flux, showing the principal parts.

Soldering aluminum cannot be done with ordinary solders. Special solders are necessary. These do not flow as easily nor melt as quickly, and the ordinary soldering iron is therefore less suitable, since higher temperatures are essential. The blowtorch (see Fig. 30) is usually employed. Some aluminum solders (those containing phosphorus) need no flux. The fluxes available are numerous, stearin being the best. If an iron is used, it must be of aluminum or nickel, and not of copper.

Even greater cleanliness of both iron and work is essential. Soldering must be done swiftly, and the lap of the joint need not be so great, to allow for the more sluggish flow of the solder. The parts to be soldered must be tinned. Large parts are best prepared as shown in Fig. 31.

A preliminary heating of the work will facilitate operations. Certain aluminum solders and the work as well may have to be heated to a red heat before melting occurs.

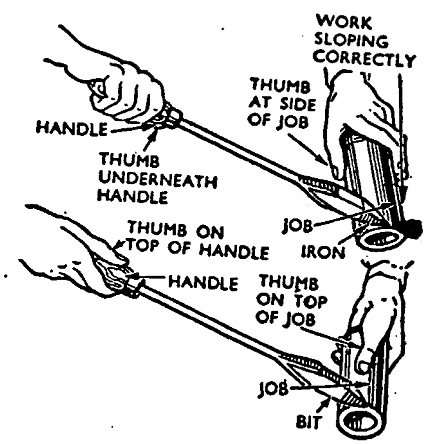


Fig. 29. Method of holding soldering iron and work. *Above*, correct method, *below*, wrong method. The thumb should be held under the handle of the iron as explained in the text.

Low-temperature solders (not above 700 deg. F.) are best. The blowtorch applies a flame directly to the surfaces to be joined, after which the solder, which is in the form of a stick or wire, is applied. The heat generated by the flame melts the metal solder, and the surplus is removed before it hardens.

BRAZING

Brazing is the union of metallic surfaces by an interposed alloy film, and is sometimes termed hard soldering, as distinct from soft soldering. The surfaces to be brazed must be carefully cleaned, every trace of grease being removed. As a cleansing agent, carbon tetrachloride can be recommended. Gasoline is unsuitable, as parts cleaned with it retain a residual oil film.

A typical small-shop job is the brazing of tungsten-carbide tips on mild-steel shanks. For tools of large section, the tip should be set in its place on the shank, after a sliver or thin sheet of electrolytic copper, together with a small amount of unfused borax, have been laid on.

The entire job must then be transferred to the furnace. A cold tip should not be placed directly into a fierce heat, as this may cause it to crack. When the copper melts, the tip should be moved a little on its seat to make sure of a satisfactory joint. After this, the tool should be removed from the furnace, and the tip pressed gently into place. The tool must then be dipped in either powdered electrode carbon, or charcoal, to insure slow cooling without contact with the air.

An alternative method is to preheat the shank to about 1500–1800 deg. F., withdraw the tool, and clean the seat with a wire brush. Borax, copper, and tip are then placed in position and replaced in the furnace. The heating is continued until the copper melts, and the same procedure as outlined above then follows. The same methods can be used with the oxy-acetylene torch for small-section tools. This method has the advantage of eliminating slag due to the time necessary for heating up the furnace, while for the smaller and many-tipped tools it facilitates local heating. The tools should, of course, be cooled off in charcoal as above.

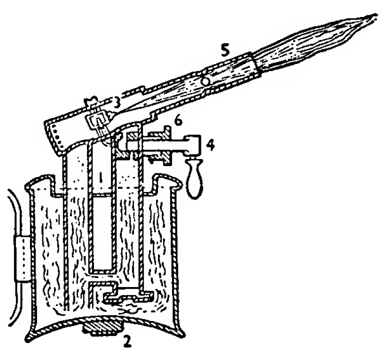


Fig. 30. Section through a soldering blowtorch for use with aluminum. 1, basin; 2, adjuster; 3, burner nipple; 4, regulator; 5, tube; 6, square for screwing up screw of regulator.

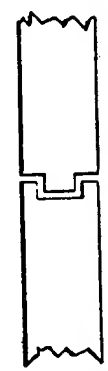


Fig. 31. Method of fitting large aluminum parts for soldering. A small pointed flame should be used.

Preparation for Brazing

In ordinary forms of brazing, the joints are cleansed with a file, followed by emery paper. Should it be necessary, they are then bound together with thin iron wire, or, if this method is inadequate, with clips. A flux of borax and water made into a stiff paste is then applied to the joint, which is then gently heated to eliminate moisture. The metal is then raised to a white heat, and the brazing alloy or spelter is plunged into the flux and applied to the joint, being rubbed on it until the spelter melts and begins to flow. The heat is then withdrawn.

It is advisable to cover almost the whole of the part being brazed with heat-conserving coke breeze or asbestos blocks. Small parts can be rested on a thick square sheet of asbestos.

Using a Blowpipe

The work should be so bound that the job can be reversed or moved during the operation without upsetting the relation of the parts. This facilitates flux and spelter application. The mouth blowpipe or the foot-bellows blowpipe can both be used for brazing, as can the gas blowpipe (Fig. 32). The former should be blown gently as continuity of air current must be sustained. Breathing should be through the nostrils and normal, but the cheeks should be tightly inflated to give a steady pressure when blowing. The flame is obtained by holding the blast end of the blowpipe immediately over the source of heat—e.g., bunsen burner or alcohol flame, the tip of which it just contacts. The blast then throws forward a long bluish flame, which is hottest at its tip (see Figs. 32 and 33). The foot-bellows is employed mainly for the heavier work, and should embody a tray or trough of sheet iron provided with coke or coke breeze, or asbestos blocks, which are grouped round the part while the blowpipe flame is directed on to the joint. A small gap must be left between the parts to be joined, but this is seldom more than a few thousandths of an inch, and, in fact, a better joint is nearly always obtained when this clearance has been reduced to the minimum.

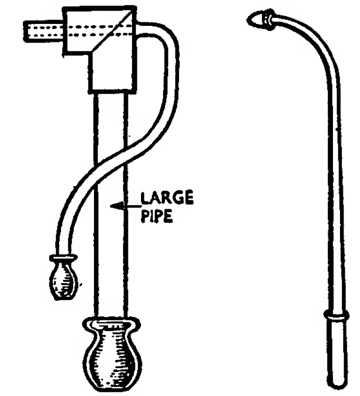


Fig. 32. *Left,* blowpipe for brazing hearth; *right,* mouth blowpipe.

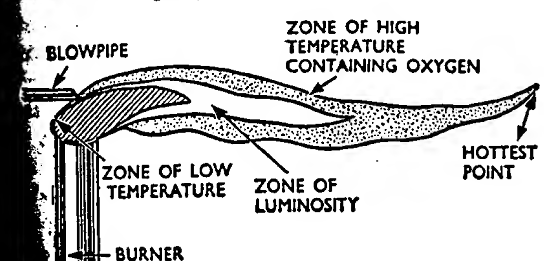


Fig. 33. Blowpipe flame. It is obtained by holding the blowpipe immediately over the flame, the tip of which it just touches.

Fluxes

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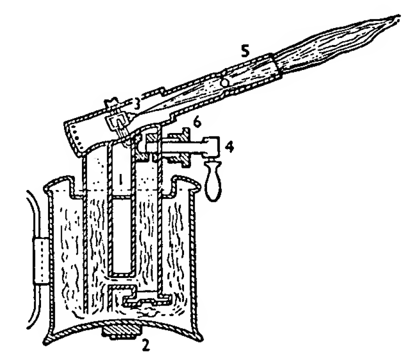

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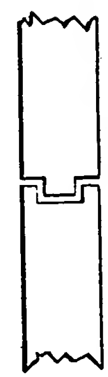

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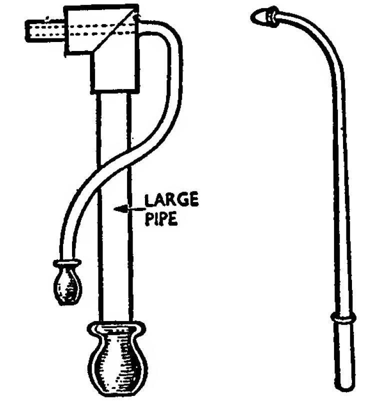

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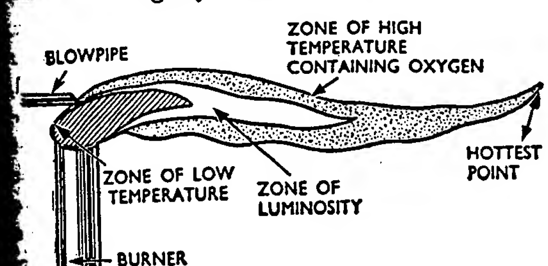

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